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Narrative recall in the elderly

Content, fluency and speech errors in the narrative speech of young, young-old and old-old speakers

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Abstract: During natural ageing, hormonal, psychological, and cognitive changes affect speech production and speech perception. The aim of this study is to investigate the differences in the performance of young-old (60- to 74-year-old) versus old-old (75- to 90-year-old) speakers in oral summaries of stories to which they listened previously and how those results relate to the speech of young adult speakers. For the present study, we have selected narrative recalls performed by fifteen subjects of each age group from BEA (The Hungarian Spontaneous Speech Database). We analysed the contents of those samples, pauses, disfluencies, and speech errors. We found important differences in the oral summaries between young-old and old-old speakers. Considerable individual differences were also attested within each age group (in disfluencies, pauses, etc.). The results suggest a certain degree of dissimilarity in the recalls across age groups, concerning peculiarities of language use along with the expected phonetic and psycholinguistic features.

Keywords: aging; recall; content; disfluencies; speech errors

1. Introduction

Due to improved living conditions and medical advances, people are living longer. The quality of life of elderly individuals can be significantly enhanced by maintaining good communication skills. Being able to understand and recall information from oral narratives is vital for everyday cognition, for life-long learning and for social activities.

At the same time, with increasing age, a number of changes occur both in speech production and in speech processing. Such developments are partly based on changes in brain functions, with consequent alterations in cognitive and psychological functions, and partly on the ageing of the organs of speech and hearing, as well as hormonal changes (Ulatowska et al. 1986; Holland & Rabbit 1990; Humes 1996; Ramig et al. 2001; Schneider et al. 2002; Hnath-Chisolm et al. 2003; Xue & Hao 2003). A number of

studies confirm that the speech comprehension of the elderly may become impeded in everyday situations even if no clinically proved hearing impairment can be found (cf. Humes 1996; Schneider et al. 2002). Speech processing in noise or the comprehension of fast speech (Janse et al. 2007; Janse 2009), the processing of grammatically complex sentences (Kemper 1987), and that of under-articulated speech (Rákli 2004) is especially difficult for elderly listeners.

Nevertheless, speech comprehension difficulties are in general primarily due to diminishing hearing sensitivity especially at higher frequencies (Hnath-Chisolm et al. 2003), compounded by a general cognitive decline resulting in the deceleration of information processing (Salthouse 1996) as well as problems of attention and memory (Schneider et al. 2002). According to the Processing-Speed Theory (Salthouse 1994), the poorer performance of old subjects in working memory tests is associated with a slowdown of the speed of processing.

Success with narrative recall is also determined by other factors: attentional and working memory mechanisms and narrative competence (Ulatowska et al. 1986; Holland & Rabbit 1990; Juncos-Rabadán & Pereiro 1999). Juncos-Rabadán et al. (2005) analysed the information content and text cohesion of narratives spoken by old versus young speakers. The authors concluded that the density of information decreases with increasing age, with a higher number of irrelevant details appearing in the text. Level of schooling positively correlates with the quality of storytelling in old age, whereas the speaker's gender does not affect his/her performance (Juncos-Rabadán 1996).

The story recalling abilities of old and young speakers have been compared in a host of studies. In Adams et al.'s (1990) experiment, narratives of a fable or non-fable form had to be recollected by subjects in four ways: total recall, summary, gist, or gist plus moral. In recalling a non-fable text, young subjects (mean age: 18.67 years) adhered to the original text a lot more than old subjects (mean age: 65.96 years) did, and the particular task largely determined their recall. In another study, Adams et al. (1997) analysed the differences between young versus old subjects' performance in recalling a narrative text in its literal vs. interpretive meaning. Young subjects were able to reach more accurate renderings when the task was to recall the story as literally as they could. However, when the same text had to be interpreted during recall, more old speakers produced profound and synthetic stories than young speakers. Bata (2010) analysed story recall by young versus old speakers in terms of information content. Her results suggested that older speakers were able to recall less information from the

texts they had heard than younger listeners, and they replaced the missing bits of information by personal reflections while recalling the original texts.

Difficulty with recall can also be linked to word finding problems (Gósy 2010). One of the most characteristic symptoms of old speech is the difficulty with lexical access (Kemper 1992). For instance, the "tip of the tongue" (TOT) phenomenon occurs far more frequently in the speech of old speakers than in the speech of young speakers. In a series of experiments involving native speakers of English, the TOT phenomenon was investigated in a natural setting: participants had to keep a diary of their own difficulties in word activation for four weeks. Older speakers produced a higher number of TOT phenomena than younger ones, especially in recalling proper names (Burke et al. 1991). Similar results were obtained in tests performed under laboratory circumstances (Horváth 2006). Word finding difficulties are more frequent in recalls than in spontaneous narratives, beacause in recalls the speakers have to remember the heard words and put them into the text (Gósy 2010).

In addition to word finding difficulties, other disfluencies and speech errors also reveal speech planning problems (Levelt 1989). The number of these problems increases in difficult tasks – such as recall – rather than in spontaneous narratives (Bóna 2011). With the help of disfluencies and speech errors, we can get an insight into speech planning processes (Goldman-Eisler 1958; Fromkin 1973; Levelt 1989; Postma et al. 1990). Disfluencies show uncertainty in the speech planning, or they are signs of self-monitoring while speaking. Speech errors are indicators of antiharmony between speech planning and implementation (Levelt 1989). In other words, disfluencies may occur when the speaker does not know how to carry on, does not find the appropriate word or grammatical form, becomes uncertain about what word to use or how to pronounce it. They also arise when while monitoring their own speech production, speakers notice an error they made and correct it (Maclay & Osgood 1959; Lallgee & Cook 1969; Postma et al. 1990).

With respect to the frequency of disfluency phenomena found in old speech, the findings have been varied. Some authors found no difference in the frequency of disfluencies between the two age groups (old versus young group; Duchin & Mysak 1987; Leeper & Culatta 1995). Others report a higher number of disfluency phenomena in old speakers' performance (Yairi & Clifton 1972). Menyhárt (2003) analysed disfluencies and errors of native Hungarian speakers in three age groups: children (9 to 12 years), middle-aged adults (22 to 45 years), and old adults (60 to 90 years). She found that

it was qualitative rather than quantitative changes that typically occurred with increasing age from the point of view of disfluencies in spontaneous speech. Our previous investigations (Bóna 2011) indicated that whenever the subjects had to talk about their own lives, work, and hobbies, there was no difference between young and old subjects in the frequency of disfluencies. However, as soon as the task became more difficult, as in having to recall stories they had just heard, young subjects produced a higher number of disfluency phenomena than old subjects did.

The above properties (disfluencies, word finding problems etc.) were found to be characteristic of the speech of elderly individuals in general, even though considerable individual differences can also be attested across old speakers (e.g., Schmitter-Edgecombe et al. 2000; Kemper et al. 2001). For instance, in a lexical access experiment, old subjects were found to show significantly more difficulty in lexical access than young subjects on picture description tasks; however, on picture naming, the performance of the former group surpassed that of the latter. Also, differences were found not only between young and old subjects but also within the group of old subjects: between young-old (60–74 years old) and old-old (75+ years old) subjects (Schmitter-Edgecombe et al. 2000). Kemper et al. (2001) analysed the grammatical complexity and information load of the speech production of healthy old subjects and those who had dementia in a longitudinal study. The results revealed that, in the case of healthy subjects, decay on the parameters studied (D-Level and P-Density) was fastest in their mid-seventies.

One thing that has not been investigated so far with respect to recalls is whether there are age-related differences within the broad category of old subjects. Another unexplored issue concerns the strategies used in recall tasks by speakers of various ages to compensate for difficulties of speech comprehension, or speech planning processes.

Summing up, the success of recall of oral narratives is influenced by several factors. Re-telling a heard story is dependent on (among several other factors) speech comprehension and speech production processes, which are altered in the elderly.

The aim of the present study is to investigate the differences between speech productions by young-old speakers and old-old speakers when they have to summarise the content of narratives they just heard, and how their results relate to those of young adults' speech production. To uncover the differences, we analyzed the following parameters: semantic content, speech fluency, and speech planning and production difficulties (measured by speech errors). Our hypotheses are as follows:

1. Due to their changed speech processing, old-old subjects will recall what they have heard less accurately than young and young-old subjects.
2. The speech of old-old speakers will be more disfluent than the speech of the other two age groups because of their difficulties of recall due to the advanced age of the old-old group.
3. The old-old speakers' difficulty of recall and speech planning will manifest themselves in more frequent speech errors than those of young and young-old speakers.
4. The overall performance of young-old subjects will be closer to that of young subjects than the performance of old-old subjects.
5. Finally, we hypothesise that text type will also affect the recalls: in each group the recalls of historical texts will be more accurate than recalls of popular science texts.

2. Material, methods, and subjects

For this study, we selected narrative recalls performed by a total of 45 speakers from the BEA Spontaneous Speech Database (Gósy 2008). In this task, the speakers had to listen to two narratives and then, after listening to each story, they had to repeat in their natural speech tempo what they had heard as closely (in as much detail) as they could. They heard both stories only once in a recorded form, spoken by a young female speaker with no speech defect. The recordings were played for the participants via speakers in a sound-treated room. One of the passages was a popular science text about communication between plants and their fraternal relationships with one another. This story was 97 seconds long and consisted of 174 words. The other text was a historical anecdote on the siege of Székesfehérvár from the time of Turkish rule in Hungary. This second story was 125 seconds long and consisted of 270 words. The lexical and grammatical features of both texts were of medium difficulty, and their comprehension did not require special knowledge. The level of difficulty in comprehensibility of the two narratives differed according to the Gunning fog index and subjective judgments made by five linguists who were native speakers of Hungarian. The fog index is an indicator of the readability of texts. It depends on the average of the number of words per sentence, and the number of long words per word. The more difficult task was the popular science text (fog index: 16.3), while the historical anecdote was easier to understand (fog index: 14.7).

We selected narrative recalls by fifteen subjects in each of the three age groups. The first group consisted of young speakers, 20 to 32 years of age, with a mean age of 25.8 years. The second group consisted of young-old speakers, 60 to 74 years of age, with a mean age of 67.6 years. Old-old speakers belonged to the third group, the age of these speakers was between 75 and 90 (mean age: 80.8 years). These age ranges correspond to what is defined by the WHO (http://www.who.int/ageing/en/, see also Kemper 1987). Each of the groups included 3 men and 12 women. None of the subjects had any known mental problems (by self-report), and their hearing was self-reported to be normal (as expected in their age range). They all lived active lives, and were in good physical condition. In the old-old group, three subjects still had jobs along with their pensions, in the young-old group, eight had jobs. In selecting our subjects, we made sure that each group included persons with equal level of education (in each group, there were 9 persons with secondary education (12 years of school) and 6 persons with higher education (16–17 years of school)), and the groups contained equal numbers of persons whose jobs involved speaking in public (e.g., teachers).

We made transcripts of the stories spoken by the subjects and annotated the recordings using Praat (v. 5.0, Boersma & Weenink 2008) at the level of phrases (portions from pause to pause). First, we noted the overall duration of each speech sample and the number of words they contained. Then, we defined ten content units in each original text; that is, twenty units in the two texts taken together. These content units included the most important elements of the texts, the characters and scenes involved in them. Then we analysed the subjects' productions from the point of view of content, counting content units in the participants' recalls as well as any additional items they introduced in their own narratives.

We measured pause durations and categorised disfluency phenomena (interruptions) and errors (due to a disharmony between speech planning and execution). Disfluencies are of the following types: silent pauses, filled pauses, repetitions, restarts, lengthenings, word-internal pauses, and filler words (expletives). Given that in the case of silent pauses it is not always easy to determine whether they signal uncertainty of speech planning or have some other function (breathing, phrasing, etc.), we discuss them separately from other disfluency phenomena.

Speech errors may occur at any level of the speech planning process. They include grammatical errors, contamination (mix-up of linguistic units at the levels of segments, syllables, words, or phrases), lexical access difficulties (false start, false word activation, TOT "tip of the tongue"), serial

speech errors (anticipation, perseveration, metathesis), as well as simple slips of the tongue (Fromkin 1973; Garrett 2001).

The data were compared across the three age groups. Statistical analyses (Kruskal-Wallis test, Mann-Whitney test, one-way ANOVA, repeated-measure ANOVA, paired t-test) were performed using the SPSS 13.0 software.

3. Results

3.1. Semantic content

First, we analysed the number of content units correctly recalled. Members of the young group displayed the best performance: for the two text types taken together, they produced on average 74.5% of the expected content units accurately. The average performance of young-old speakers was 44.5% accurate, and old-old speakers produced only 40% of the expected content units correctly. Considering the two types of narratives separately – popular science vs. historical anecdote –, young speakers gave a significantly better performance in either task than young-old and old-old speakers. In the science text for the three age-groups the Kruskal-Wallis test was $\chi^2 = 25.029$, $p \leq 0.001$; Mann-Whitney test: young speakers vs. young-old speakers: $Z = -4.062$, $p \leq 0.001$; young speakers vs. old-old speakers: $Z = -4.437$, $p \leq 0.001$. In the historical anecdote for the three age-groups the Kruskal-Wallis test was $\chi^2 = 12.281$, $p = 0.002$; Mann-Whitney test: young speakers vs. young-old speakers: $Z = -2.758$; $p = 0.006$; young speakers vs. old-old speakers: $Z = -3.240$; $p = 0.001$. Young speakers performed at 73% accuracy level on average in the science text and at 76% in the historical anecdote condition. Young-old speakers reached an average of 35% in the former and 54% in the latter. Old-old speakers performed at 29% for the science narrative recall and at 51% for the historical anecdote. Large individual differences were attested within each group. The least accurate performance was given by a 71-year-old subject (10–10%), whereas out of the two upper age groups, an old-old subject (76) gave the best result (65–90%).

Comparing the two narrative types, the historical anecdote yielded better results than the science report in all three age groups (fig. 1). When comparing the two types of narratives produced by the young-old group, a statistically significant difference was found ($Z = -2.233$, $p = 0.026$), indicating better results for the historical anecdote. A comparison between the historical anecdote and the science narrative also revealed a difference

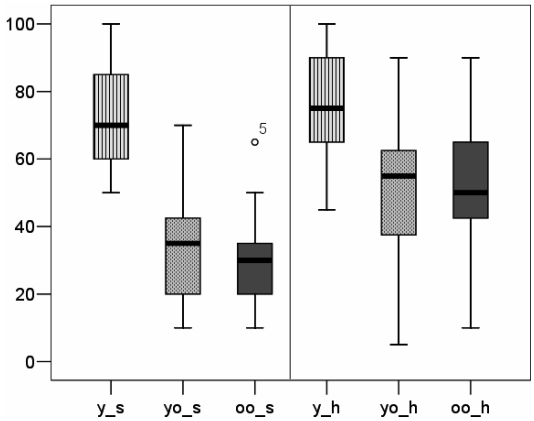

Figure 1: Recalled/expected content units by age and text type (%) (y = young, yo = young-old, oo = old-old; s = popular science, h = historical anecdote).

for the old-old group ($Z = -3.092$, $p = 0.002$). In the young group, there was no significant difference between the two narratives.

In addition to correctly recalled (expected) content units, the subjects' narratives also included incorrect (unexpected) pieces of information. These were content units that either did not appear the original narratives at all, or had traces in the original narrative but were recalled inaccurately. Incorrect content units were partly due to perceptual difficulties (e.g., the name *Varkocs György* was misheard as *Markos György*). Other units suggested a fault in semantic processing (e.g., some subjects did not understand the role of the citizens in the defence of the fort in the historical anecdote), and yet others may have had wrong or inaccurate associative operations in the background; for instance, some of the old-old subjects were simply unable to draw appropriate conclusions (this happened in three cases). In the original historical anecdote, the Sultan ordered that the citizens who had betrayed the Hungarians be executed and that the valiant soldiers be set free. The three old-old subjects at hand said that they were wondering why it was not the citizens who were set free by the Turks since it was they who wanted peace.

In recalling the narratives, the participants also relied on their background knowledge. Two members of the young group elaborated on what they had heard on the basis of their prior knowledge. Such additions organically fit into the text and did not change its overall content. One 31-year-old subject, for instance, embellished the citizens' betrayal. The

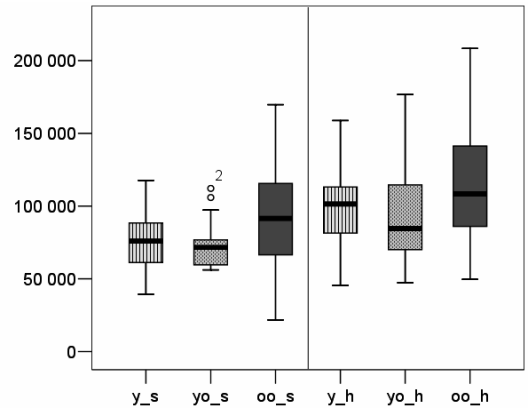

Figure 2: The duration of speech productions by text type and age (ms) (y = young, yo = young-old, oo = old-old; s = popular science, h = historical anecdote).

original narrative only said that the citizens broke their oath, changed their mind, and gave up the castle.

There were also instances when the subjects offered their own reflections on the narrative rather than simply repeating it. This was the case in at least one of the narrative types with 80% of the old-old subjects, 40% of the young-old subjects, and 13% of the young subjects. One old-old participant (75 years) talked almost exclusively about her own reflections on the science narrative, merely recalling two expected content units of the original narrative, yet she spoke the longest (343 s, 686 words).

3.2. Length of recalls

We analysed the length of the individual speakers' speech production. Irrespective of the type of narrative, old-old speakers produced the longest summaries (222 s on average, exactly corresponding to the total duration of the original texts, or 100%). The shortest average length (166 s or 75% of the duration of the original narratives) was produced by young-old speakers. The duration of re-tells of young speakers fell in the middle (174 s or 78% of the duration of the original narratives).

The duration of speech production by narrative type and age group is illustrated in figure 2. In each group, speakers used less time for recalling the science text that was shorter to begin with than for summarising the historical anecdote. In the latter case, standard deviations and ranges were

invariably larger in all three groups. For instance, in the old-old group, the subject with the shortest re-tell summarised the story in 55 s (44% of the length of the original text), while the longest-speaking participant used 208 s (166% of the original duration). Young subjects recalled the science text in 75 s on average (77%), and the anecdote in 99 s (79%). Young-old speakers used 74 s for the science text (76%), and 92 s for the anecdote (74%). Old-old speakers had longest summaries, taking 106 s (109%) on average for the science text and 116 s (93%) for the anecdote. Despite the considerably longer average re-tell times of old-old speakers, the differences across the three age groups were not statistically significant. In the young group, there was a significant difference in duration between the science text and the anecdote (the latter being longer): $t(14) = -3.839$, $p = 0.002$; whereas in the other two age groups, there were no significant length differences between narrative types. Comparing the ratios of the length of the recalls to the length of the original narratives, no significant differences between the two narrative types were found in any of the age groups.

The analysis of word counts yielded similar results both for text types and for age groups (fig. 3). On average, the fewest words were used by young-old speakers, the highest number by old-old speakers, and the word count of young speakers was an intermediate value. Young speakers used an average of 136 words to render the science text (78% of the word count of the original text), and 164 for the anecdote (61%). Young-old speakers uttered an average of 117 words for the science text (67%), and 144 words (53%) for the anecdote. The highest number of words was produced by the old-old speakers, an average of 178 words for the science text (102%), and 179 words for the anecdote (66%). Although the number of words tended to grow from young and young-old to old-old age, no significant differences were found here either. Nor was there a significant difference between the word counts of the two types of text within the individual age groups. However, in terms of percentages of words used to re-tell the narrative, we found a significant difference: the young-old group used significantly fewer words to recall the science text than during the summary of the anecdote (one-way ANOVA: $F(1, 28) = 4.932$, $p = 0.035$).

3.3. Pauses, disfluencies and speech errors

The properties of silent pauses were similar in the three age groups, and there were no significant differences either in the overall ratio of pauses to the total length of speaking, the frequency of silent pauses, or their

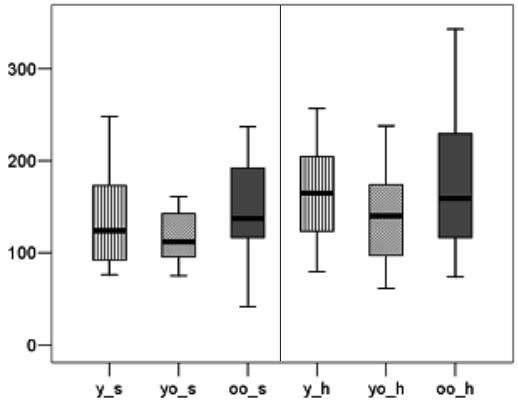

Figure 3: Number of words produced, by age and text type; (y = young, yo = young-old, oo = old-old; s = popular science, h = historical anecdote). (A data point in the speech production containing the highest number of words is excluded as one of the old speakers re-told a scientific text with 686 words.)

average length (table 1). In recalling the science text, old-old speakers paused somewhat more often and more lengthily than young speakers. In this narrative type, old-old speakers kept a higher number of long pauses than young speakers. In recalling the historical anecdote, it was young speakers that produced pauses the most often and for the longest time. We also compared the two narrative summaries within each age group. We only found a significant difference in the young group: the members of this group paused significantly more in the historical text than in the science narrative: $t(14) = -4.011$; $p = 0.001$.

Disfluencies, or breaks in the fluency of speech, may signal speech planning difficulties. In what follows, we analyse disfluencies other than silent pauses. It was young speakers who produced disfluency phenomena the most frequently: one in every 6.65 words (in the two narrative conditions pooled). Young-old speakers produced an instance of disfluency every 7.85 words, and old-old speakers every 11.55 words. Text types influenced the frequency of disfluency phenomena in every age group. The young subjects recalled the science text with an average of one disfluency in 6.8 words (SD: 3.4), and one in 6.5 words in the historical anecdote (SD: 3.2). Young-old speakers' performance included an instance of disfluency every 6.7 words in the science text (SD: 3.4), and every 9.0 words in the historical anecdote (SD: 5.4). Old-old speakers produced disfluency every 9.2 words in the science text (SD: 5.2), and every 13.9 words in the his-

Table 1: Pausing: Ratio of total length of pauses relative to whole time of speaking, frequency and average length of pauses

	young		young-old		old-old	
	Mean	SD	Mean	SD	Mean	SD
	Popular science					
Pause ratio (%)	26.8	5.9	28.9	9.4	29.3	8.6
Frequency (words/pauses)	4.4	1.4	3.9	1.2	4.1	1.1
Average length (ms)	623	118.6	690	250.1	695	244.2
	Historical anecdote					
Pause ratio (%)	32.3	7.7	28.7	8.1	31.9	9.1
Frequency (words/pauses)	3.8	1.0	3.9	1.4	4.0	1.3
Average length (ms)	730	182.0	678	170.4	800	268.6

torical anecdote (SD: 19.3). On the other hand, as far as the frequency of disfluencies is concerned, there was no significant difference either across age groups or across narrative types, probably due to the large ranges again. The wide range in the number of disfluencies produced by old-old speakers is due to a 76-year-old speaker whose performance contained a mere seven instances of disfluency (not counting silent pauses) in the two narratives taken together. There was no significant difference between the two narrative types in terms of frequency of disfluencies, in any of the age groups.

The frequency of disfluencies is related to the number of content units that the given subject is able to recall (cf. Gósy 2010). Young speakers attempted the most accurate interpretation possible; hence, they had more difficulty in speech planning and thus produced more instances of disfluency than young-old speakers who produced less accurate renderings or old-old speakers who mainly concentrated on their own reflections.

The types of disfluencies also show age-related differences (fig. 4). It is typical that young speakers' speech includes more filled pauses (by 8.7 percentage point (pp) in the science text and 4.3 pp in the anecdote) than the old-old speakers' performance, while young-old speakers' performance is between the other two groups. The second most frequent type of disfluency with both young and young-old speakers was lengthening (26.7% in young speakers and 24% in young-old speakers, both narrative types considered together), while old-old speakers were more prone to using repetitions (17.4%) and filler words (18.3%). The proportions of types

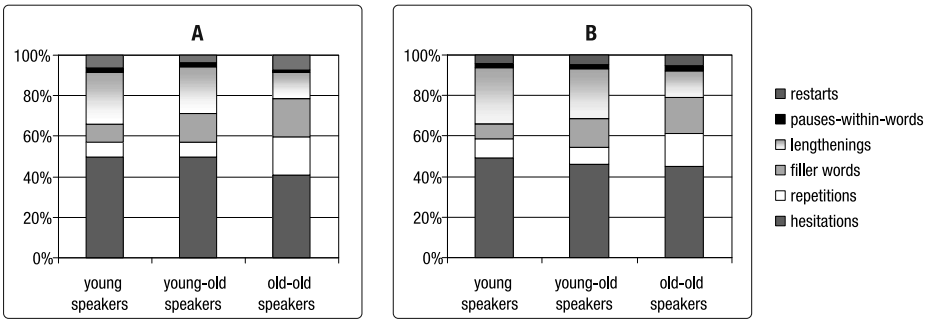

Figure 4: Types of disfluencies in the popular science text (A) and in the historical anecdote (B).

of disfluency tended to remain constant across text types with the largest difference (4.3 pp) being in filled pauses produced by old-old speakers.

Speech errors occurred most frequently in the productions of old-old speakers'. We detected fewer errors in the speech of younger speakers than in the other two age groups. In the case of the historical narrative, this difference was significant between the young and the old-old groups (difference across groups in recalling the historical anecdote: $\chi^2 = 7.205$, $p = 0.027$; young vs. old-old: $Z = -2.676$, $p = 0.007$). Young speakers erred in their summaries of the science text once in 95.8 words (SD: 57.5 words/error) and in the historical anecdote once in 102.9 words (SD: 50.9 words/error). Young-old speakers produced an error in the science text every 81 words (SD: 46.1 words/error), in the historical anecdote every 76.9 words (SD: 46.6 words/error). Old-old speakers' errors occurred in the science text every 61.3 words (SD: 33.9 words/error), and in the anecdote every 73.1 words (SD: 40.1 words/error).

In the error types of both narratives, we also found differences between the age groups: the two older groups produced more types of errors than the young group (fig. 5). In all three age groups and both narrative types pooled, lexical access difficulties (tip of the tongue, wrong word choice, false start) were the most frequent (young speakers: 50.6% of all errors, young-old speakers: 46.8%, and old-old speakers: 50% of all errors), followed by errors of grammatical planning (young speakers: 23%, young-old speakers: 31.1%, old-old speakers: 24.6%). Thus, within all errors committed by a given age group, lexical access difficulties occurred in similar proportions. On the other hand, if we also take into account the fact that old-old speakers produced far more errors than the other two groups, there were far more lexical access problems per total word count in this age group

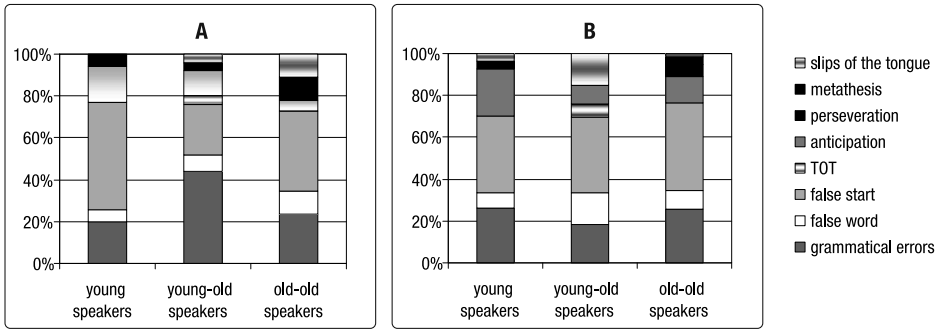

Figure 5: Error types in the popular science text (A) and in the historical anecdote (B) (TOT = "tip of the tongue" phenomenon).

than in the other two. This means that errors suggesting a problem in lexical access occurred in every 141 words in young speakers' summaries (both narratives pooled), every 131 words in young-old speakers' summaries, and every 97.5 words in old-old speakers' summaries.

Young speakers displayed anticipation the most often (in both narratives together, 19.4% versus young-old speakers: 10.3% and old-old speakers: 9.1%). Perseveration occurred the most often in the old-old group, accounting for 8.1% of all errors, in both narratives combined. In young speakers, 4.8% of all errors were perseverations, and in young-old speakers, only 1.7% of all errors were perseverations.

Despite accurate speech planning and good articulatory programming, the actual articulatory movement can also be erroneous: this is when a slip of the tongue is produced. A single slip of the tongue was found in young speakers' narratives (in each type) as opposed to young-old speakers' 10.3% of all errors being slips of the tongue, and 6.4% of all errors were slips of the tongue in the old-old group.

There were also differences in error type frequencies across narratives. For instance, the most often attested word finding difficulty occurred in the young group: every 102.4 words in the science text but only every 204.7 words in the historical anecdote. In young-old speakers' recalls of the science text, word finding errors occurred every 195.3 words, while in their recalls of the anecdote, such errors were attested once every 113.9 words. In the speech of old-old speakers, lexical retrieval errors occurred every 98.9 words in the science text and every 96.1 words in the historical anecdote. The differences may be due to the fact that for young subjects recalling the science text proved to be more difficult than recalling the

anecdote (i.e., the results concerning the content units); or alternatively, for them the exact repetition of the words or expressions occurring in the science text was more important (hence, also more difficult). Members of the young-old and old-old groups were able to recall so few content units of the science text that they did not even attempt to retrieve the actual words or expressions from their lexicon. On the contrary, they tried to give a more exact recall of the historical text; hence, in their case, it is in this narrative type that lexical access difficulties were attested more often than in the popular science text.

In sum, members of the young group could recall the highest number of exact content units, but their speech was the least fluent. Young-old speakers and old-old speakers were able to recall 30–34.5 pp fewer content units on average but their speech production was characterised by fewer disfluencies. An important difference between the latter two groups was that young-old speakers spoke for a shorter time than old-old speakers did. The latter group of subjects included more pieces of individual reflections than members of the other groups. The highest number of speech errors was attested in the speech of old-old speakers. The frequency of various types of disfluencies and speech errors was age-dependent. We also found differences with respect to the types of narrative to be recalled: the participants were able to recall fewer content units from science texts than from historical texts, and the two narrative types exhibited differences in terms of the frequency of disfluencies and speech errors.

4. Conclusions

The aim of this study was to compare the performance of young, young-old and old-old speakers of Hungarian concerning narrative summaries of orally presented texts. We concluded that both the subjects' age and the type of narrative affected the accuracy of recall and speech production processes. Accuracy of recalled content interacted with speech planning and execution in a particular age-specific manner: speakers (mostly young ones) who recalled the content of the text faithfully produced more disfluencies than speakers who were able to recall fewer content units.

With respect to speech comprehension, our first hypothesis claiming that old-old subjects will recall information less accurately than young and young-old subjects was verified. The results suggest that the level of text comprehension and the ability to recall content units deteriorate already in young-old age (above 60). However, there are large individual differences: text comprehension and recall do not get worse over time to the same

extent in all individuals, because one of our old-old (76-year-old) subjects was able to recall no less than 90% of the content units of the historical narrative.

Our second hypothesis, according to which the speech of old-old speakers will be more disfluent than the speech of the other two age groups, was not confirmed. The most fluent speech was produced by old-old speakers, followed by young-old speakers, and the least fluent speakers were members of the young group. The frequent instances of disfluency produced by young participants were probably due to their aspiration to be faithful to the original narrative, which is also confirmed by the ratio of successfully recalled content units in their case.

Partially confirming the third hypothesis, young speakers produced speech errors in significantly smaller numbers than members of the two other age groups. This means that the speech production of the young-old and the old-old group revealed less harmony between their speech planning and execution than that of the young group. Age-related differences were found both in the types of disfluency exhibited and the types of error committed. The data also showed considerable individual variation in all three age groups, attested by wide ranges of deviation for all parameters investigated in the present study.

With respect to speech production, the present study has shown that the content of speech affects the frequency of disfluencies to a larger extent than the speaker's age. Statistical analyses revealed that there were no differences across age groups in pausing and in the frequency of disfluency phenomena; in other words, at least in the case of recall tasks, the fluency of speech does not change with ageing. Young-old and old-old speakers produce speech errors more often than young speakers do, but the difference is only significant in comparing the old-old group to the young group.

According to the fourth hypothesis, young-old speakers were expected to perform similarly to young speakers in certain features of their production, and to old-old speakers in others. As far as the average length of speech production and word count are concerned, young-old speakers came close to the performance of young subjects. On the other hand, in the number of content units recalled young-old reached results more closely resembling those of old-old speakers. This suggests that at a young-old age, recall memory works less accurately than at a young age, and textual faithfulness is less complete in recall tasks than in the case of young speakers. Conversely, young-old subjects formulated their speech briefly and succinctly, just like young subjects did. An important difference between

old-old speakers and young-old speakers was that old-old speakers added their own opinions to their narratives far more frequently than young-old speakers. Old-old speakers talked for a long time, often digressing from the topic, probably in order to counterbalance their linguistic, memory-related, and cognitive difficulties. It is also possible that older speakers are less motivated to repeat information as exactly as they can, or that the young group – closer to the school years – is better trained in such a task than older speakers. Furthermore, psychological reasons could also motivate old-old subjects adding their own opinions: old-old speakers tend to have a narrower network of social relationships and social roles, and an experimental situation such as the one in this experiment simply gives them an opportunity to carry on a conversation and state their views.

Finally, the fifth hypothesis ("the type of the text will affect the recalls") was verified in the young-old and old-old groups. The recalls of historical anecdotes were more accurate than recalls of the popular science text.

An analysis of recalls makes it possible for us to get a clearer grasp of the reasons why people of various ages use different communication strategies during their everyday communication.

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